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THE HAWAIIAN ELEPAIO.

BY VAUGHAN MACCAUGHEY.

THERE is no other region in the world with an avifauna more remarkable or interesting than that of the Hawaiian Archipelago. In extraordinary endemism, specialization, and precinctivity, the Hawaiian bird life is without parallel. Due to the operations of various malign influences, the native forests and birds have greatly diminished within historic times. Many known species of plants, trees, and birds have become wholly extinct, and many others are on the verge of extinction. A time is speedily approaching in which the extinct avian species will exceed in number those still surviving.

The one indigenous forest bird that appears to successfully withstand the devastating influences of "civilization" is the Hawaiian Flycatcher or Elepaio.¹ This form is now the most abundant representative of the native woodland avifauna. In many regions it appears to be practically the sole survivor. A peculiar interest is therefore attached to this beautiful and familiar denizen of the mountain forests.

Although the literature relating to Hawaiian bird life is voluminous, most of it is inaccessible to the average ornithological worker. Moreover, there is nowhere in the literature a comprehensive and modern account of this most abundant of the Hawaiian birds. During a residence of ten years in the islands, the author has had occasion to visit all representative parts of the native forests, and has spent many months in actual field work. He has been particularly interested in field studies and in the ecologic view-point, rather than in taxonomy. The present paper embodies the results of his own field studies, the examination of museum material, and a summary of the literature. In so far as is known to the author, this is the only monographic account of the Hawaiian Elepaio.

¹ Vowels pronounced as in Latin.

Family.— The Old World Flycatchers, *Muscicapidae*, comprising about 60 genera and some 400 species, are represented in the Hawaiian avifauna by *Chasiempis* only. The family is common in Ethiopian, Indian, and Australian regions; several are Palearctic, and 4 or 5 reach Europe. The family is fairly abundant in the islands of the South Pacific, but in the central North Pacific is confined to the Hawaiian group.

Genus.— The genus *Chasiempis*, comprising all the Hawaiian species, was established by Cabanis in 1847 (*Archiv für Naturgeschichte* 1847: 207). The members are true Flycatchers, with broad soft beaks, the gape of which is beset with long, strong, spreading bristles. The tarsus is characteristically long and slender. The first primary is about one-half as long as the second; the second is about one-fourth inch shorter than the third; the fourth, fifth, and sixth are equal and longest. The tail is about as long as the wing; the rectrices are pointed. The sexes are similar in size and plumage, but the juvenile plumages differ in many striking particulars from those of the adult birds.

Key to adult birds.— The specific status of the Elepaio for many decades was a subject of great perplexity to ornithologists, and led to extended discussions and controversies. The careful studies of such workers as Rothschild, Perkins, Wilson, and Bryan, have reduced the chaotic synonymy to order and conclusively demonstrated that there are three valid species,— one each for the islands of Kauai, Oahu, and Hawaii.

Much perplexity and confusion arose from the numerous intergrading plumage changes through which all the species pass before they reach maturity. The differences between the mature and juvenile birds have misled ornithologists to describe them under different names, so that as many as six or more species were recognized by some investigators, while others have referred all to a single species.

The adults of all three species are characterized by wing-coverts spotted with white; black or white or both on the throat; tail-coverts white; lower mandible dark. The adults of all species have the rump white; the young have the rump tawny. They not infrequently breed in quite immature plumages; there are numerous records of pairs, one white-rumped, the other rufous-

rumped. The following key is rewritten and modified from the excellent keys of Rothschild and Bryan.

- A. Upper-parts bluish-gray or smoky;
Kauai only. KAUAI ELEPAIO,
C. sclateri.
- AA. Upper-parts brownish.
 - B. White tips of outer-tail-feathers
usually longer than .50 inch;
white tips and outer edgings of
secondaries neither wide nor
prolonged; Hawaii only. HAWAII ELEPAIO,
C. sandwichensis.
 - BB. White tips of outer-tail feathers
usually shorter than .50 inch;
white tips and outer edging of
secondaries quite pronounced;
Oahu only. OAHU ELEPAIO,
C. gayi.

Key to juvenile birds.—In all three species the wing-coverts of the young birds are spotted with tawny brownish-yellow (white in adults); throat brownish-yellow, without black or white; base of lower mandible light.

- A. Browner above, brownish-yellow of
throat and tail-coverts deeper;
head not so brownish-yellow;
Hawaii only. HAWAII ELEPAIO,
C. sandwichensis.
- AA. Lighter, more brownish-yellow above,
throat and upper-tail-coverts
rusty brownish-yellow.
 - B. Occurs on Oahu only. OAHU ELEPAIO,
C. gayi. fig. 2.
 - BB. Occurs on Kauai only. KAUAI ELEPAIO,
C. sclateri. fig. 3.

Chasiempis sandwichensis (Gmel.) THE HAWAII ELEPAIO.

SYNONYMY — Sandwich Flycatcher; Spotted-winged Flycatcher; Brown-faced Flycatcher; *Muscicapa sandwichensis* Gm.; *Muscicapa sandwicensis* Lath.; *Muscicapa maculata* Gmel.; *Cnipolegus* sp. ScL.; *Eopsaltria* (*Chasiempis*) *Sandwichensis* Gray; *Eopsaltria* (*Chasiempis*) *maculata* Gray; *Chasiempis sandwicensis* ScL.; *Chasiempis sandwichensis* Finsch & Hartl.; *Chasiempis ridgwayi* Stejn.; *Chasiempis ibidis* Stejn.

PLUMAGE — There seems to be a tendency toward a differentiation into sub-species. According to Henshaw birds on the windward side of the island have forehead, lores and superciliary stripe *chestnut*; birds on the leeward side have these parts *white*. This has been confirmed by other collectors. There is no noteworthy difference in the plumage of the sexes. The following very detailed descriptions, which may be taken as typical for the group, have been revised and amended from the careful descriptions by Rothschild.

Final adult plumage: Forehead, lores, and superciliary stripe white or chestnut, more or less spotted, the bases of the feathers black.

Above, from the head to the back, dark olive-brown or bistre, tinged with rufous and spotted with white on the hind-neck and lower back.

Rump and upper-tail-coverts pure white, base of feathers black.

Wing-coverts (except primary-coverts) and inner secondaries black, broadly tipped with white. Primary coverts black. Quills blackish-brown, narrowly edged on the outer webs with olive-brown, distinctly edged with white on the inner webs, the first ones only at the basal parts.

Rectrices black, outermost pair with half of the outer web to the tip white, and with the tip of the inner web for $\frac{1}{4}$ to at least $\frac{1}{3}$ white.

The remaining tail feathers have a large portion of the inner web and a much smaller portion of the outer web white; these spots decreasing in size until the central pair is reached, where only quite narrow white tips are visible.

Feathers of the under-parts black at their bases, white at the tips. The chin remains quite black, then the white tips appear, so that the throat is varied white and black. The white tips become so broad that the entire lower throat, breast, abdomen, and under-tail-coverts are pure white.

Sides of the breast and body are more or less washed with tawny-olive. Under-wing-coverts spotted brown and white, the bases being deep brown, the tips broadly white. Feathers of the thighs black with white tips. Iris dark brown; upper mandible slaty-black, under mandible slaty-blue; legs and feet slaty-blue.

Intermediate plumage: Birds having this plumage may be adult and breed, but it is not the final plumage described above.

Above dark olive-brown with a rufous shade, thus appearing a trifle brighter than the final plumage.

Lores, forehead, and a more or less distinct line above and behind the eyes tawny brownish-yellow, sometimes mixed with whitish or white.

Rump and upper-tail-coverts white, the bases of the feathers black.

Quills dark brown, narrowly margined with pale tawny on the outer webs, with creamy buff on the inner webs, more so toward the bases. Secondaries tipped with white.

Rectrices broadly tipped with white, as in the final plumage, but the white color does not extend so far.

Chin and throat spotted black and white, in younger specimens appearing almost pure white. This variation is caused by the feathers being black at the base and more or less broadly tipped with white.

Under-parts below the throat dark tawny brownish-yellow, with a broad, more or less irregularly defined, white patch on the upper breast, and extending to the under-tail-coverts, which are also white. Feathers of the thighs black, tipped with white. Under-wing-coverts deep brown and white.

Iris, bill, legs and feet as in final plumage.

Juvenile plumage: Above tawny brownish-yellow. Pale tawny on rump, browner on head and upper-tail-coverts. Quills dark brown, with pale borders on outer webs and bordered with buff on inner webs.

Wing-coverts deep brown, broadly tipped with bright brownish-yellow buff.

Tail-feathers deep brown, with pale borders to the outer webs. Outermost pair with a small white spot on the outer web and a large white spot on the inner web; the next pairs with white on inner webs only. All these white spots are much less extended than in adult birds and decreasing in size to the middle, so that the central pair of feathers has no white.

Under-parts tawny buff, passing into white on middle of abdomen. Some specimens are much whiter than others. Under-wing-coverts buff.

Iris dark brown. Upper mandible deep brown; lower mandible brown at tip, creamy yellowish at base. Legs and feet slaty-blue, but less bright and paler than in adult birds.

Measurements of adults.

	inches		inches
Length.....	5.50-6.00	Bill, depth.....	.20
Wing.....	2.70-3.05	Bill, width.....	.18
Tail.....	2.40-2.70	Tarsus.....	0.85-0.90
Culmen.....	.47- .53	Toe.....	.63

Chasiempis gayi Wilson. THE OAHU ELEPAIO.

SYNONYMY — Gay's Flycatcher, Oahu Flycatcher; see also under 1.

PLUMAGE — *Adult male:* Upper-parts brownish (feathers with bluish bases), washed with tawny brownish-yellow, especially about the head.

Forehead rusty brownish-yellow. Lores and about the eyes white.

Wing-coverts brownish-black, forming a well-defined bar. Lesser coverts tipped less regularly with white. Primaries brown with buff edges. Tail-coverts white.

Chin white. Throat black with more or less white tips (not so conspicuous as in the Hawaii species). Breast with some reddish brown. Abdomen white.

Intermediate plumage: Similar to that of the young, but showing brownish-black in the throat, and more or less white in the wing and tip of tail.

Juvenile plumage: Above tawny yellowish-brown, most yellowish on sides and back of neck.

Forehead, lores, chin, throat and chest tawny brownish-yellow.

Wing-coverts and primaries brown with brownish-yellow edges. Larger wing-coverts sometimes showing white tips, forming a bar less conspicuous than in adults.

Upper-tail-coverts tawny-brownish-yellow. Under-tail-coverts tawny. Abdomen white.

The plumages of the female and young differ from the male in the same manner as those of the Kauai species.

The Oahu species is distinguished from that of Hawaii, with which it was long confused, by its more conspicuous white throat and almost entirely white breast. Seale has given an excellent account of the plumage changes of this species.

Measurements of adults.

	inches		inches
Length.....	5.50-6.00	Culmen.....	.40- .45
Wing.....	2.55-2.65	Tarsus.....	.95-1.00
Tail.....	2.50-2.55	Toe.....	.60

Oahu has been more completely despoiled of its native bird life than any other of the larger islands. More of the known Oahu passerine species are extinct than are living today. The Oahu Elepaio is the most abundant of the remaining native birds and is practically the only species commonly seen.

***Chasiempis sclateri* Ridgway. THE KAUAI ELEPAIO.**

SYNONYMY — Dole's Flycatcher, Sclater's Flycatcher, *Chasiempis dolei* Stejneger. *A-peke-peke* is the designation used by the natives of Kauai for the rufous-rumped form; the white-rumped form is called Elepaio. The first name is used exclusively on Kauai.

PLUMAGE — *Adult male:* Upper-parts uniform dark smoky-gray. Lores and superciliary stripe whitish or buffy-white.

Wing-coverts blackish. Greater and lesser coverts tipped with white forming two fairly distinct bars across the wing. Quills blackish with grayish-fulvous edges tipped with white.

Upper-tail-coverts pure white.

Center of throat white surrounded by buffy and buffy-gray, forming a more or less distinct pectoral girdle. Sides of body grayish-white with a wash of rusty.

Abdomen and under-tail-coverts white.

White on outer web of tail-feathers narrow and extending along the edge for the greater part of its length; white tip about .35 inch long.

The throat and forehead of the adult female are much whiter than those of the adult male.

The young are very rufous above and chiefly orange-rufous below, with tawny-under-tail-coverts and rusty wing bars.

Measurements of adult.

	inches		inches
Length.....	5.25-5.50	Bill, depth.....	.16
Wing.....	2.55-2.95	Bill, width.....	.22
Tail.....	2.35-2.60	Tarsus.....	.80-.89
Culmen.....	.45-.50	Toe.....	.65

This species is abundant in all forested parts of the island; it was observed, mating and nesting, along the Na Pali coast.

The appearance, ranges, habitats, habits, calls and song, breeding habits, nests, eggs, and life-cycles of the three species, in so far as known, are so very similar in every respect that in the remaining sections of this paper, save where otherwise noted, they will be considered as ecologically a single form. Field observations fully warrant this point of view.

RANGE: The native passerine birds of the Hawaiian Islands fall into three groups, according to range. 1. Those which occur on all the main islands of the group. 2. Those which occur on several islands, but also are absent from several islands. 3. Those which are confined to a single island only, and (in many cases) to very limited areas on that island. The genus *Chasiempis* belongs to the second group; the species fall in group three.

The genus occurs on Kauai, Oahu, and Hawaii, and is absent from the islands of Niihau, Molokai, Maui, Lanai, and Kahoolawe. The absence from Niihau and Kahoolawe (the two smallest of the eight large islands), may be explained by deforestation; the primitive forest mantle has been wholly destroyed. Lanai and West Molokai have been largely denuded of forest. East Molokai and Maui, however, possess extensive forest belts closely resembling those of Kauai, Oahu, and Hawaii.

There is no evidence to show that the Elepaio has become

extinct on Molokai and Maui. On the contrary, the evidence is fairly conclusive that this form never inhabited the Molokai-Maui-Lanai-Kahoolawe land-unit. The present islands composing this unit are separated by channels less than 600 feet in depth, and originally constituted a single continuous land-mass. Isolation has taken place through subsidence.

Two theories are tenable concerning the inter-island distribution of *Chasiempis*. These theories also apply to many other Hawaiian organisms. According to one theory the primitive ancestor, from which *Chasiempis* evolved, landed upon the shores of one of the three islands which it now inhabits, as a chance immigrant or waif.¹ After a long period of time fortuitous inter-island migration occurred, which resulted in the chance establishment of the bird on Kauai, Oahu, and Hawaii, but in some unknown way missed the Maui-Molokai group. Through isolation the forms on the three islands developed as endemic species.

The second theory derives the three present species from an ancient stock which inhabited the primitive pan-Hawaii-land. This land, many times larger and higher than the present island-group, reached from northern Hawaii to and probably far beyond Niihau, and has been lost through profound subsidence. The present islands are the apices of subsided mountains.² The primitive Elepaio ranged through pan-Hawaii-land and during subsidence was isolated on the three islands already mentioned. For some unknown cause it failed to continue on the Maui-Molokai unit.

The altitudinal range of *Chasiempis* on Kauai (5250 ft.) and Oahu (4040 ft.) is approximately from 800 ft. to the highest summits. Originally, when the forests covered much more of the lowlands than at present, and extended down to the strand in many districts, the Elepaio was abundant at the lower levels. On Hawaii (rising nearly to 14,000 ft.) the Elepaio ascends to the upper limits of the forest zone (7,000-9,000 ft.) and descends in certain places nearly to sea-level. It is most abundant between

¹ Just as a pair of Belted Kingfishers (*Ceryle alcyon*) landed and lived on the shores of Hawaii, several years ago.

² William Alanson Bryan, Deep Submergence of the Waianaes. Vaughan MacCaughey, Outstanding biological features of the Hawaiian Archipelago.

1000 and 3000 on all the three islands. This wide altitudinal range, which embraces a number of climatic zones, is greater than that of any other native woodland bird, and strikingly indicates the versatility and generalized character of this bird.

Aside from the primitive inter-island or pan-Hawaiian migration the Elepaio does not give any evidence of migration. Within historic times the range has sensibly diminished. There are no observable migration movements within the present range of the species.

HABITAT: The Elepaio is essentially a bird of the humid and mesophytic forests, and is abundant in all parts of its range. It avoids such habitats as arid treeless sections, wind-swept summit ridges, and the very hygrophytic summit bogs, although even in the latter situations it sometimes occurs. It is most plentiful in the protected wooded ravines and on the valley slopes, especially in the somewhat open formations, where the sunlight penetrates, the humidity is not super-excessive, and insects abound.

Typical situations are the forests in the Waimea, Na Pali, and Hanalei districts of Kauai; the Waianae and Koolau Ranges of Oahu, especially in the Punaluu district; and the forests of Kona, Hamakua, and Kohala, Hawaii. The author has studied the species in all of these localities.

It ranges from the ground to the summits of the tallest trees (nearly 100 ft.) Its average elevation is 6-20 ft. from the ground in the shrubbery and tree-crowns. It is not a ground-loving bird, although it frequently descends to the ground in search of insects. The Elepaio, on the other hand, is not distinctive of the treetops, although when the *lehua* (*Metrosideros polymorpha*) is in bloom, the bird haunts the flowery crowns in quest of the insect visitors.

During an eight-weeks' pedestrian tour of the island of Hawaii the author noted the prevalence of the Elepaio in the extensive *koa* and *lehua* forests. In many regions the bird appears to be more abundant on the leeward than on the windward side of the island.

Next to the *lehua* the Elepaio's favorite haunt is probably the *mamake* (*Pipturus albidus*), because of the large insect fauna characteristic of that shrub. Seventy-five or more species of insects and their parasites have been reported as inhabiting the *mamake*; nine species are not known to occur on any other plant.

Food Habits.—The Elepaio is almost exclusively insectivorous. There is no evidence of vegetable food, save possibly nectar. In its feeding habits it combined the traits of the Flycatcher and the Wren, with strong resemblance to the latter. It catches insects in three ways,—on the wing, from vegetation, and from the ground. It often follows and catches insects on the wing, but does not sit for long intervals and watch for prey, as do the American Flycatchers. In its aerial chase the Elepaio's beak snaps audibly in closing. The author has often sat motionless in a secluded situation in the rain-forest and observed the Elepaio's aerial maneuvers. The flight is rapid, usually silent, with considerable fanning of wings and tail, and manifest ability in turning sharp corners.

Most of the insect food is gleaned from the branches and foliage of trees and shrubs, and from the thick envelopment of mosses, lichens, liverworts, etc., which covers the woody vegetation in the rain-forest. Insect larvæ comprise an important element of the diet. Beetles, mature and as larvæ, myriapods, flies, moths, caterpillars of many species, together with spiders and slugs, are the dominant items on the food-list.

Not infrequently the Elepaio feeds from the ground,—among the dead *koa* leaves, in the fern banks, and upon prostrate and mouldering tree trunks. Myriapods, larvæ, spiders and slugs are gathered in these situations. The author has commonly observed the Elepaio feeding on or very close to the ground on the steep slopes in the montane rain-forests of Oahu and Kauai, as well as on the gentle slopes of Hawaii. He has never seen vegetable food eaten by this bird.

The Elepaio feeds all day long, from dawn to darkness, without cessation. There is no special feeding time; the bird is apparently insatiable and always on the *qui vive* for food. Seale found, in a large series of birds shot under widely varying conditions, that all had their stomachs literally gorged with insects and larvæ. The Elepaio is keen-eyed and quick of movement; it catches and devours insects with great rapidity. It holds down large moths in its claws, and tears off the wings, etc., before swallowing the morsel. The author has observed the bird methodically pull off the legs and wings of various adult insects, in preparation for swallowing.

The economic value of the Elepaio as a destroyer of noxious

insects is very high. These pests have multiplied prodigiously in recent years, and it is to be deeply regretted that the native birds are not sufficiently abundant to hold them in check. All native passerine species are now rigidly protected by law, and are rarely molested, in any direct way, by man.

Habits.—Perennial restlessness is an outstanding Elepaioan trait. The birds are always on the move. They chase and scold one another, sometimes more than two participating. When there are several birds in the same immediate vicinity, their program is a continual round of frolic, scolding, and feeding. Fearlessness and curiosity make the Elepaio conspicuous in the woodlands, whereas the other native birds slip away silent and unseen. The young birds are particularly tame and curious. Young and old alike will approach within a few feet of the quiet observer. Their inspection is sometimes silent, but more often is accompanied by chattering and scolding. They are pugnacious to birds other than their own kind, and will chase large birds away from a favorite feeding ground. The author has frequently observed the Elepaio chase and harass such species as *Vestiaria coccinea* and *Chlorodrepanis stejnegeri*.

The Elepaio has a number of distinctive little mannerisms with wings and tail. Sometimes it droops the wings and cocks the tail up over its back, remarkably like a Wren. Often, upon alighting, it spreads the tail fanwise. The male is not known to manifest any special peculiarities of habit or song during the mating season.

Song and call-notes.—The name Elepaio is the Hawaiian rendition of the simple song, which is scarcely more than a call "E-lé-pai'-o." This is also variously translated,— "O-nó-ká'-ia," "Pe-pá-kéo," "Too-wée-óo," etc. The notes are whistled very clearly and distinctly and carry a long distance. Occasionally the author has heard the bird singing *sotto voce*.

According to the natives the Elepaio is invariably the first bird to sing in the early dawn. In many native legends this matin takes the place of the cock-crowing of European folk-tales, at which time the demigods, ghosts, and fairies must cease their nocturnal enterprises, even though they be incomplete. The bird sings at all hours of the day, and occasionally, when disturbed, at night. The Elepaio has no special song in the mating season, nor are there noteworthy variations in the song.

Another call-note is a sharp "wheet, who" or "tweé-ou" uttered repeatedly and with piercing shrillness. This "whit" call has a true Flycatcher quality. Frequently the Elepaio meets the human intruder with a scolding "chrr, chrr, chrr." Several gurgling call-notes are also used, particularly when the bird is engaged in catching insects. It has no true flight-song, but on rare occasions sings while on the wing. The young birds sing during the first fall and winter. Altogether the Elepaio possesses at least seven or eight calls, and possibly this number reaches a dozen or more.

Natives' Ideas.—To the early Hawaiians the Elepaio was a sacred bird, a demigod (*aumakua*), and capable of omening. It occupied a prominent place in native mythology and was revered by the canoe-makers as a presiding genius of their labors. The canoes were hewn chiefly from the massive trunks of the *koa*, which grew abundantly in the Elepaio's range. Many religious rites and ceremonies preceded and accompanied the selection, felling, and shaping of the trunk. If the Elepaio, while inspecting a trunk previously selected by the natives for canoe-making, pecked at it in a certain way, or uttered certain notes, the trunk, even though partially felled, was abandoned by the natives as unfit for use. The author has conversed with many of the old-time Hawaiians concerning the Elepaio and has found that they always speak of the bird with great respect. The modern natives know little or nothing of this lore.

Breeding habits.—There is little accurate information concerning the breeding habits of any of the native passerine birds, owing to the extreme difficulties of studying these birds in the field. More is known concerning the Elepaio, however, than of any other native bird.

No special phenomena of courtship have been observed. It not uncommonly pairs and breeds before assuming the mature plumage. This fact has been determined through observations of nesting birds, and by the examination of a large series of specimens. The exact length of time during which the intermediate plumage is worn is not known, but there is undoubtedly considerable variation at different elevations and situations on the several islands. The Elepaio, so far as is known, is monogamous; it probably takes a new mate for each nesting season.

The breeding season begins in the late winter and early spring (February, March, April), during the latter part of the rainy season, and is conditioned by the severity of the rains. Eggs and young have been found in the nests in March, April, and May. The species are single-brooded.

The nest is the most ornate and easily found of the known nests of Hawaiian birds. The nests and eggs of all three species are identical in every respect. The nest is usually built in a small tree, 6-40 feet from the ground. Occasionally it is placed near the ground, but this is exceptional. Henshaw found a nest on a horizontal tree-fern trunk (*Sadleria*) within two feet of the ground. The Elepaio apparently does not nest in the very high treetops (60-90 ft.) The average elevation is about 20 ft. It is the only Hawaiian woodland bird that habitually nests at low elevation from the ground.

In this connection it should be noted that the introduction of the Mongoose (*Herpestes griseus*) in 1883, for the purpose of eradicating rats from the sugar-cane fields, resulted in great damage to native bird life. The Mongoose quickly found its way up into the forest zones, and has seriously decimated the ranks of all low-nesting birds. The author has found the Mongoose, for example, in all parts of the Oahuan forests, up to an elevation of 2500 ft., and on Maui and Hawaii it ranges to much higher elevations.

The Elepaio shows no preference for any particular species of tree or shrub, but uses any one that is suitable for its purpose. Nests have been found in *Metrosideros polymorpha*, *Acacia koa*, *Dodonaea viscosa*, *Santalum freycinetianum*, *Pipturus albidus*, *Maba sandwichensis*, and other common trees of the humid forests. Interesting light is thrown upon the Elepaio's adaptability by the fact that it occasionally nests in the dense thickets of foreign introduced shrubs, such as guava (*Psidium guayava*) and lantana (*Lantana camara*). These invaders now cover large areas in the lower portions of the Elepaio's range. The other native birds are practically never found in these naturalized thickets, but the Elepaio has evidently taken the change as a matter of course.

The nest is usually placed in an upright fork or saddled upon a horizontal branch and supported by lateral twigs. It is well concealed by foliage. The author has found on two occasions

nests in horizontal forks at the extreme ends of horizontal branches. The nest is a neat, compact, and beautiful structure. It is usually made of grasses, fine roots, moss, or leaves, firmly woven into a deep cup. The strong skeletonized frames of the leaves of various forest trees are commonly used as nest material. There is much variation in size, some nests being 2-3 times as high and wide as others. Typical dimensions are, 1.5 inches deep, 2 inches diameter, walls .75 inch in thickness. Nests 3.25 inches deep and 2.50 inches in diameter are not rare. The exterior is abundantly and artistically decorated with bits of fern-frond or lichen, held in place by silk from spiders' webs. The lining is of fine moss and vegetable fibers. The fine fibers of the *pili* grass are commonly used for the lining. Wilson found a nest which was made almost exclusively of the bleached calyces of the *poha* (*Physalis peruviana*), and that was of unusual delicacy and beauty.

As a rule two eggs only are laid, although sometimes there are three. The intervals between deposition are not known, but probably do not exceed a day or so, as the young emerge at about the same time and do not manifest marked differences in age. The egg is 1.25 inches long by 1.11 inches in diameter; the deviations from this average are very slight. The shape is ovate. The ground-color is pure grayish-white or very pale yellowish, with no indication of bluish or greenish tints. The egg is more or less heavily marked with small spots, speckles, and blotches of brown or reddish-brown; the under spots are pale lilac. The spots are usually most numerous around the larger end of the egg. Both sexes take part in the construction of the nest, incubation of the eggs, and in the feeding of the young. Practically nothing is known concerning the rearing and development of the young. There are no native predatory land-mammals or serpents in the Hawaiian islands; the only animal enemies of the Elepaio during the nesting season are the introduced rats, mongoose, and wild house-cats. The *kona* or southerly storms, which are of frequent occurrence during the nesting season, undoubtedly often prove fatal to the life of the nest.